

Date: Fri, 30 Sep 94 04:30:33 PDT
From: Ham-Homebrew Mailing List and Newsgroup <ham-homebrew@ucsd.edu>
Errors-To: Ham-Homebrew-Errors@UCSD.Edu
Reply-To: Ham-Homebrew@UCSD.Edu
Precedence: Bulk
Subject: Ham-Homebrew Digest V94 #290
To: Ham-Homebrew

Ham-Homebrew Digest Fri, 30 Sep 94 Volume 94 : Issue 290

Today's Topics:

 More on RC model Transmitters
 More on RC model Transmitters/Legalities
 Toroid on feedline absorbs power? (2 msgs)
 Torroid on feedline absorbs power? (2 msgs)
 Yagi antenna analysis program.

Send Replies or notes for publication to: <Ham-Homebrew@UCSD.Edu>
Send subscription requests to: <Ham-Homebrew-REQUEST@UCSD.Edu>
Problems you can't solve otherwise to brian@ucsd.edu.

Archives of past issues of the Ham-Homebrew Digest are available
(by FTP only) from UCSD.Edu in directory "mailarchives/ham-homebrew".

We trust that readers are intelligent enough to realize that all text
herein consists of personal comments and does not represent the official
policies or positions of any party. Your mileage may vary. So there.

Date: Tue, 27 Sep 1994 21:19:00 PST
From: ihnp4.ucsd.edu!swrinde!howland.reston.ans.net!torn!nntp.cs.ubc.ca!
mala.bc.ca!news.island.net!ham!emd@network.ucsd.edu
Subject: More on RC model Transmitters
To: ham-homebrew@ucsd.edu

mack@mails.imed.COM writes:

> I agree with Gary about the legalities. You should IMMEDIATELY desist
> if you are using 6M even if you are a licensed amateur! Given the
> current mood of the FCC, you could get some VERY big fines for this if
> caught.
>
> Now to your technical needs. If you haven't been in model RC stuff
> very long, you probably are not aware of the history of the current
> specifications. The channels were narrowed, the modulation bandwidth
> was narrowed, and more channels were added. The suggestion that Gary
> made is a good one if you are using the 72MHz stuff. The only problem

> is that you will be doing this illegally, too. This is Part 15
> equipment and must be type approved before use. This means you are
> not allowed to mess with the antenna or have external power
> amplifiers.
>

I haven't seen the earlier parts of this thread, but there are channels set aside for RC work ON six metres. From 50.8 to 50.98, every 20 KHz is a channel for RC. Granted, you need to be an amateur to use this, but why would the FCC frown on this?

--

emd@ham.island.net (Robert Smits VE7EMD Ladysmith BC)

Date: 28 Sep 1994 14:36:09 GMT
From: yuma!galen@purdue.edu
Subject: More on RC model Transmitters/Legalities
To: ham-homebrew@ucsd.edu

In article <092794211950Rnf0.79b4@ham.island.net> emd@ham.island.net writes:

>
>I haven't seen the earlier parts of this thread, but there are channels
>set aside for RC work ON six metres. From 50.8 to 50.98, every 20 KHz is
>a channel for RC. Granted, you need to be an amateur to use this, but why
>would the FCC frown on this?

He stated they were using RC to control models for filming movies. This is a commercial use of amateur radio, and that's a very big NO-NO.

Galen, KF0YJ

Date: 27 Sep 1994 17:13:07 GMT
From: news.tek.com!tek4.cse.tek.com!royle@uunet.uu.net
Subject: Toroid on feedline absorbs power?
To: ham-homebrew@ucsd.edu

acooney@netcom.com (Alan Cooney):

>I've an antenna in a harsh environment, where the feedline can get s
>wet at various points. The varying wetness causes shifts in VSWR that
>are unpredictable, as they appear to hit 'nodes' in the feedline. I
>looped the feedline many times through a ferrite torroid located right
>at the feed of the dipole, and the result has been a reduction in the

>effect I was seeing before -- apparently due to a reduction in signal
>travelling on the outside of the coax. So is that external energy
>being absorbed by the ferrite (ie., wasted power), or is the torroid
>giving me a high impedance 'choke' -- effectively just closing the door
>on that rf path? Oh, and the frequency is ~50MHz.

If the toroid is absorbing a significant amount of energy, there can be only one possible result: it will get hot.

Most of the ferrites used for this purpose have a mostly resistive impedance at the frequency of use. This means that they will dissipate power if current flows through the winding(*). The object, though, is to reduce the current to a very low value. If the winding has a sufficiently high impedance, the current will be small, and the dissipation in the core will be negligible.

73,
Roy Lewallen, W7EL
roy.lewallen@tek.com

(*) To be more specific, we're talking about the NET current through the winding. In the case of coax, this equals the current flowing on the outside.

Date: 27 Sep 1994 13:37:44 -0500
From: ihnp4.ucsd.edu!swrinde!pirates.cs.swt.edu!cs.utexas.edu!not-for-mail@network.ucsd.edu
Subject: Toroid on feedline absorbs power?
To: ham-homebrew@ucsd.edu

: royle@tekgp4.cse.tek.com (Roy W Lewallen) said,

]acooney@netcom.com (Alan Cooney):

]

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]>wet at various points. The varying wetness causes shifts in VSWR that
]>are unpredictable, as they appear to hit 'nodes' in the feedline. I
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]core will be negligible.
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]73,
]Roy Lewallen, W7EL
]roy.lewallen@tek.com
]
]
](*) To be more specific, we're talking about the NET current through the
]winding. In the case of coax, this equals the current flowing on the
]outside.

I think this is a misdiagnosis and that a toroid "choke" is not the
right fix. If you're getting standing waves apparent along the
outside of the coax, you've got some *serious* mismatch going on to
begin with. Check the *end* insulators, which must provide high
isolation despite moisture. Re-check the antenna's tuning (remember
grid-dip meters?) for the frequency you're using and feed your dipole
through a balun. While you're at it, see that any guy lines are
broken up with insulators to prevent resonances and that the antenna
is sufficiently far (say, a few wavelengths) from conductive
structures.

OTOH, if your coax is wicking water *inside* along the braid, that can
cause some interesting effects as well.

Moy Wong (moy@xp.psych.nyu.edu) Dept. of Psychology, New York University

Date: 27 Sep 1994 17:21:32 GMT
From: ihnp4.ucsd.edu!swrinde!howland.reston.ans.net!EU.net!Germany.EU.net!
news.dfn.de!news.belwue.de!news.uni-stuttgart.de!moritz@network.ucsd.edu
Subject: Torroid on feedline absorbs power?
To: ham-homebrew@ucsd.edu

Allan,

The losses in your choke depend on the material used. I guess
that on 50 MHz most ferrites will be quite lossy.

The best solution will be to use a proper balun, as published by the ARRL and others.

IMO the best is to build a folded dipole with a 4:1 cable balun. or replace your dipole with a groundplane.

Hope you will have success, Moritz DL5UH

Date: Thu, 29 Sep 1994 09:25:38 GMT
From: hearst.acc.Virginia.EDU!cabell.vcu.edu!jwill@uunet.uu.net
Subject: Torroid on feedline absorbs power?
To: ham-homebrew@ucsd.edu

What Terry says is correct. To make a good current balun for 50 MHz you will need some torroid cores to slip over the outside of the coax right at the antenna feed..... A quick check of the ARRL Antenna Handbook gives the following information about what type of torroids to order from Amidon:

For RG-58 type coax: Use 50 of the FB-43-2401 Torroids

For RG-213 or RG-8 size coax:
Use 12 of the FB-43-1024 torroids.

Type 43 material is the stuff you want for VHF work. And Type 73 or type 77 is the type you want for HF work.

Robert S. Williams, MD
KD4ZPH

Date: 29 Sep 1994 04:43:14 -0500
From: cs.utexas.edu!not-for-mail@uunet.uu.net
Subject: Yagi antenna analysis program.
To: ham-homebrew@ucsd.edu

I've written a program for the analysis of Yagi Uda antennas.

TITLE: YagiUda-1.0.tar.Z

PURPOSE: To analyse performance of Yagi-Uda antennas. You give the dimensions and positions of each element, and the program calculates gain, input impedance, front-to back ratio, beam-patterns etc. An optimisation program 'optimise' tries to optimise a design.

This can be had by anonymous ftp from:

medphys.ucl.ac.uk

username: anonymous

password: your e-mail address.

It is in the directory /pub.

Note that the program does *not* presently run under DOS. It only runs on a unix machine. It has been compiled on both a Sun and a PC running unix.

Please feel free to ftp the file if you wish.

The programs are public domain, but I've used a few copy-righted routines for mathematical calculations from the book 'Numerical Recipes in C' by Press et al, Cambridge University Press, (1992). You will need to purchase this book to get the source for these - its *not* included in my distribution.

Dave Kirkby G8WRB.

Date: 28 Sep 1994 12:18:00 GMT

From: agate!howland.reston.ans.net!math.ohio-state.edu!jussieu.fr!univ-lyon1.fr!
elendir@ames.arpa

To: ham-homebrew@ucsd.edu

References <368kkb\$a6q@proffa.cc.tut.fi>, <368ov9\$mn0@cismsun.univ-lyon1.fr>,
<36bl54\$gab@proffa.cc.tut.fi>.

Subject : Re: Interdigital filters

Kein{nen Paul (k23690@proffa.cc.tut.fi) wrote:

: elendir@enst.fr wrote:

: So, it is not the Eiffel tower, which has a really impressive antenna farm.

: This farm has certainly grown since I visited the place a few years ago :-)

The Tour Eiffel is a high place, you're right. But it costs a lot of money to install an antenna, because there is really little space. Still, there is a 400 to 1200 transponder here, courtesy of a commercial FM radio which gave a small place to install it.

Whereas le Petit Clamart is on a hill - probably higher than the top of

la Tour Eiffel, and the roof is free !

: Apparently you do not have any high power (> 1kW) transmitters on the site
: and thus a notch type duplexers with some additional band-pass filtering
: could do.

I guess so.

[...]

: insufficient). To conclude, a duplexer, some bandpass filtering prior
: to the preamp, a preamp with good strong signal handling characteristics
: and some additional band-pass filtering between the preamp and the
: receiver should be employed.

Okay. I ll try to figure this out.

Thanks for your very kind advice. I ll let you know about this project if
you are interested...

Vincent

--

F1RCS - Worldwide Friendship through Amateur Radio
ENST, Ecole Nationale Supérieure des Telecommunications, Paris

Date: Wed, 28 Sep 1994 06:52:00 +0000
From: ihnp4.ucsd.edu!swrinde!howland.reston.ans.net!news.sprintlink.net!demon!
ifwtech.demon.co.uk!G3SEK@network.ucsd.edu
To: ham-homebrew@ucsd.edu

References <366ddd\$9q@cismsun.univ-lyon1.fr>,
<1994Sep26.123247.16457@ke4zv.atl.ga.us>, <368kkb\$a6q@proffa.cc.tut.fi>
Reply-To : G3SEK@ifwtech.demon.co.uk
Subject : Re: Interdigital filters

Here is a version of the program you want. I do not know if the algorithms are
valid for the very narrow bandwidths you
need - your milage may vary HI.

```
10 KEY OFF: CLS
20 COLOR 3, 0: LOCATE 2, 16: PRINT "DESIGN DATA FOR INTERDIGITAL BANDPASS
FILTERS": COLOR 7, 0: PRINT
21 PRINT "    Rook & Taylor (1970); Hinshaw N6JH & Monemzadeh (Ham Radio, Jan
1985)"
```

```

22 PRINT "                                I/O revision by G3SEK 1989-91"
23 '    Uses equal diameter rods
24 '    G values based on ripple BW. Q/coup on BW @3dB
30 DEF FNRJ (TA, B, C, D) = (B * C - TA * D) / (C * C + D * D)
40 DIM A(200), B(200), C(200), G(200), RK(200), AK(200), FR(100), ALOSS(100)
50 PI = 4 * ATN(1): NFR = 20: N = 3: RIP = 0!: FZGC = 1!: BWMC = 50!: FIRST = -1:
ENTER$ = CHR$(17) + CHR$(217)
52 LOCATE 8, 1
54 PRINT "                Press M for millimetres, or I for inches > ";
56 T$ = INPUT$(1)
58 IF T$ = "M" OR T$ = "m" THEN UNIT$ = "mm": CV = 25.4: ELSE IF T$ = "I" OR T$ =
"i" THEN UNIT$ = "in": CV = 1 ELSE GOTO
54
60 PRINT UNIT$
70 LOCATE 10, 1: PRINT SPACE$(75): LOCATE 10, 1
72 IF FIRST THEN PRINT "                        Groundplane spacing, top-bottom ("; UNIT$; :
INPUT ") : ", H ELSE GOTO 76
74 IF H <= 0 THEN BEEP: GOTO 70 ELSE H = H / CV
76 IF NOT FIRST THEN PRINT USING "                        Groundplane spacing, top-bottom
(&) = ###.###"; UNIT$; H * CV
80 LOCATE 11, 1: PRINT SPACE$(75): LOCATE 11, 1
82 IF FIRST THEN PRINT "                        Rod diameter ("; UNIT$; :
INPUT ") : ", D ELSE GOTO 88
84 IF D <= 0 THEN BEEP: GOTO 80
86 IF D > (.9 * H * CV) THEN BEEP: GOTO 80 ELSE D = D / CV
88 IF NOT FIRST THEN PRINT USING "                        Rod diameter
(&) = ###.###"; UNIT$; D * CV
90 LOCATE 25, 10: COLOR 3, 0: PRINT "Press " + ENTER$ + " for default values shown
in [square brackets]"; : COLOR 7, 0
100 LOCATE 12, 1
110 PRINT USING "Overhang from centre of first _& last rod [###.###&] :"; .7 * H *
CV; UNIT$;
120 INPUT " ", E: IF E = 0 THEN E = .7 * H ELSE E = E / CV
130 PRINT USING "                        Number of elements (7 or less) [###] :"; N;
135 INPUT " ", T: IF T <> 0 AND T < 8 THEN N = T
140 PRINT USING "                        Passband ripple (dB, 0=Butterworth) [#.###] :"; RIP;
145 INPUT " ", T$: IF T$ = "0" THEN RIP = 0 ELSE T = VAL(T$): IF T <> 0 THEN RIP =
T
150 PRINT USING "                        Centre frequency (GHz) [###.###] :"; FZGC;
155 INPUT " ", T: OLDFZGC = FZGC: IF T <> 0 THEN FZGC = T
159 IF (FIRST OR OLDFZGC <> FZGC) THEN BWMC = 50 * FZGC' Default bw = 5%
160 PRINT USING "                        Bandwidth (MHz) [###.##] :"; BWMC;
165 INPUT " ", T: IF T <> 0 THEN BWMC = T
170 INPUT "                        Input/output impedance [50] : ", R
175 IF R = 0 THEN R = 50
180 PRINT
182 PRINT "Number of plotting points required at each side of centre, and freq
step -"

```



```

184 PRINT USING "      Points [###] :"; NFR / 2;
186 INPUT " ", T: IF T <> 0 THEN NFR = 2 * INT(T)
190 IF NFR > 50 THEN NFR = 50
192 STP = .5 * BWMC
194 PRINT USING "Step (MHz) [###] :"; STP;
196 INPUT " ", T: IF T <> 0 THEN STP = T
198 '
200 COUNT = 0
210 FOR IP = -NFR / 2 TO NFR / 2
220     COUNT = COUNT + 1
230     FR(COUNT) = FZGC + (STP * .001 * IP)
240 NEXT IP
250 F1 = FZGC - .0005 * BWMC
260 F2 = FZGC + .0005 * BWMC
270 IF RIP > 0 THEN GOTO 330
280 BW3GC = F2 - F1
290 BWRGC = 0
300 BW3 = 1
310 GOSUB 2000 ' Butterworth response
320 GOTO 390
330 B = 1 / SQR(10 ^ (.1 * RIP) - 1)
340 CA = LOG(B + SQR(B * B - 1)) / (N)
350 BW3 = (EXP(CA) + EXP(-CA)) / 2
360 GOSUB 1700 ' Chebyshev response
370 BWRGC = F2 - F1
380 BW3GC = BWRGC * BW3
390 '
400 W = 2 * (F2 - F1) / (F2 + F1)
410 QF = FZGC / BW3GC
420 NFM = N - 1
430 QWVL = 11.8028 / (4 * FZGC)
440 FOR K = 1 TO NFM
450     AK(K) = 1 / (BW3 * SQR(G(K) * G(K + 1)))
460     RK(K) = AK(K) / QF
470 NEXT K
480 AK0 = G(1) * BW3
490 AK(N) = AK0
500 AK(N + 1) = 0
510 QS = G(1) * BW3 * QF
520 CANH = (EXP(2 * PI * E / H) - 1) / (EXP(2 * PI * E / H) + 1)
530 ZM = 59.9585 * LOG(4 * H / (PI * D))
540 ZE = 59.9585 * LOG(CANH * H * 4 / (PI * D))
550 RKM = RK(1) * SQR(ZM / ZE)
560 Z = PI * D / (2 * H)
570 COTH = (EXP(Z) + 1) / (EXP(Z) - 1)
580 Y = PI * RKM / 4
590 T = COTH ^ Y
600 C(1) = (H / PI) * LOG((T + 1) / (T - 1))

```

```

610 MFL = N - 2
620 ' IF N-3<0 THEN AG=1 ELSE
IF N-3=0 THEN AG=2 ELSE AG=3
630 ON (2 + SGN(N) * 1) GOTO 690, 690, 640
640 FOR K = 2 TO MFL
650     Y = PI * RK(K) / 4
660     T = COTH ^ Y
670     C(K) = (H / PI) * LOG((T + 1) / (T - 1))
680 NEXT K
690 C(N - 1) = C(1)
700 X = SQR(PI * R / (4 * ZE * QS))
710 AQ = 2 * QWVL * ATN(X / SQR(1 - X * X)) / PI
720 QU = 2200 * H * SQR(FZGC)
730 SUMG = 0
740 FOR J1 = 1 TO N
750     SUMG = SUMG + G(J1)
760 NEXT J1
770 BLOSS = 4.34 * FZGC * SUMG / (QU * (F2 - F1))
780 DELA = SUMG / (2 * PI * (F2 - F1))
790 CLS : COLOR 3, 0: PRINT "DESIGN DATA FOR "; N; " POLE INTERDIGITAL FILTER":
COLOR 7, 0
800 IF RIP > 0 THEN PRINT "Passband ripple "; RIP; " dB" ELSE PRINT "Butterworth
response"
830 PRINT USING "Centre freq.      ###.#### GHz"; FZGC
840 PRINT USING "Cutoff freqs      ###.#### and ###.#### GHz"; F1; F2
850 PRINT USING "Ripple bandwidth  #.##### GHz"; BWRGC
860 PRINT USING "    3dB bandwidth  #.##### GHz"; BW3GC
870 PRINT USING "Fractional bandwidth  #.####"; W
875 PRINT
880 PRINT USING "Filter Q          #####"; QF
885 PRINT USING "Estimated Qu      #####"; QU
890 PRINT USING "Loss based on this Qu  ##.# dB"; BLOSS
895 PRINT USING "Delay at band centre  ###.# ns"; DELA
900 LOCATE 25, 35: COLOR 3, 0: PRINT "Press " + ENTER$; : T$ = INPUT$(1): CLS
920 PRINT "FREQUENCY REJECTION INFORMATION"; TAB(67); "GHz"; TAB(74); "dB": COLOR
7, 0: PRINT
930 FOR JK = 1 TO NFR + 1
940     NFN = ABS(2 * (FR(JK) - FZGC) / (W * FZGC))
950     IF RIP > 0 THEN GOTO 980
960     ALOSS(JK) = 10 * LOG(1 + NFN ^ (2 * N)) / LOG(10)
970     GOTO 1020
980     IF NFN < 1 THEN NFN = 1
990     ANG = N * LOG(NFN + SQR(NFN * NFN - 1))
1000    YAK = .5 * (EXP(ANG) + EXP(-ANG))
1010    ALOSS(JK) = 10 * LOG(1 + (10 ^ (.1 * RIP) - 1) * YAK * YAK) / LOG(10)
1020    ALOSS = ALOSS(JK)
1030    FR = INT(FR(JK) * 10000) / 10000
1040    COLOR 14, 0: IF ALOSS < 64 THEN PRINT TAB(INT(ALOSS) + 1); "*"; ELSE PRINT

```

```

TAB(64); ">";
1045  COLOR 7, 0: IF ALOSS > 99.99 THEN ALOSS = 99.99
1050  PRINT TAB(66); : PRINT USING "#.### ##.##"; FR; ALOSS
1055  NEXT JK
1060  W0 = 2 * PI * FZGC * 1E+09
1070  F = D / H
1080  CF = (-.0000422 + .0857397 * F + .0067853 * F * F - 9.092165E-02 * F ^ 3 +
.169088 * F ^ 4) * PI * H * 2.54
1090  '
1100  WW = W0 * 1E-12
1110  B2 = PI * AQ / (2 * QWVL)
1120  GG = 1 / R
1130  BB = -COS(B2) / (ZE * SIN(B2))
1140  EL1 = .8 * QWVL
1150  ANG = EL1 * PI / (2 * QWVL)
1160  B1 = ANG - B2
1170  YL = -COS(ANG) / (ZM * SIN(ANG))
1180  CP = WW * (CF + .17655 * D * D / (QWVL - EL1))
1190  Y1 = CP + YL
1200  EL2 = .87 * QWVL
1210  ANG = EL2 * PI / (2 * QWVL)
1220  B4 = ANG - B2
1230  YL = -COS(ANG) / (ZM * SIN(ANG))
1240  CD = WW * (CF + .17655 * D * D / (QWVL - EL2))
1250  Y2 = CD + YL
1260  EL3 = .95 * QWVL
1270  ANG = EL3 * PI / (2 * QWVL)
1280  B5 = ANG - B2
1290  YL = -COS(ANG) / (ZM * SIN(ANG))
1300  CQ = WW * (CF + .17655 * D * D / (QWVL - EL3))
1310  Y3 = CQ + YL
1320  ELEM = Y3 * Y2 * EL1 / ((Y1 - Y2) * (Y1 - Y3)) + Y1 * Y3 * EL2 / ((Y2 - Y1) *
(Y2 - Y3)) + Y1 * Y2 * EL3 / ((Y3 - Y1) *
(Y3 - Y2))
1330  TANN = SIN(B1) / COS(B1)
1340  YL = FNRJ(GG, BB + TANN / ZE, 1 - ZE * BB * TANN, ZE * GG * TANN)
1350  Y1 = CP + YL
1360  TANN = SIN(B4) / COS(B4)
1370  YL = FNRJ(GG, BB + TANN / ZE, 1 - ZE * BB * TANN, ZE * GG * TANN)
1380  Y2 = CD + YL
1390  TANN = SIN(B5) / COS(B5)
1400  YL = FNRJ(GG, BB + TANN / ZE, 1 - ZE * BB * TANN, ZE * GG * TANN)
1410  Y3 = CQ + YL
1420  ELEQ = Y3 * Y2 * EL1 / ((Y1 - Y2) * (Y1 - Y3)) + Y1 * Y3 * EL2 / ((Y2 - Y1) *
(Y2 - Y3)) + Y1 * Y2 * EL3 / ((Y3 - Y1) *
(Y3 - Y2))
1430  COLOR 3, 0: LOCATE 25, 25: PRINT "Press R to revise, " + ENTER$ + " to
continue";

```

```

1435 T$ = INPUT$(1): CLS : COLOR 7, 0: IF T$ = "r" OR T$ = "R" THEN FIRST = 0:
GOTO 70
1440 PRINT USING "Width (= quarter_-wavelength)   ###.##&"; QWVL * CV; UNIT$
1450 PRINT USING "Height                           ##.##&"; H * CV; UNIT$
1460 PRINT USING "Rod diameter                     ##.##&"; D * CV; UNIT$
1470 PRINT USING "External ### lines connect at ##.##& from ground end"; R; AQ *
CV; UNIT$
1475 PRINT "End covers are required unless overhang is larger than default value"
1480 IF N > 5 THEN COLOR 3, 0: LOCATE 25, 30: PRINT "Press " + ENTER$ + " for
sketch"; : T$ = INPUT$(1): CLS : COLOR 7, 0
1490 IF N > 5 THEN STARTLIN = 4 ELSE STARTLIN = 8
1500 LOCATE STARTLIN, 1: COLOR 3, 0
1510 PRINT " Ele #           Length                               Centre-to-centre
Cumulative";
1515 COLOR 7, 0
1520 F1$ = " (edge)
###.##" + UNIT$
1530 F2$ = "                                           ###.##" + UNIT$
1540 F3$ = "   #           ###.##" + UNIT$ + "
###.##" + UNIT$
1550 CUMU = 0: LOCATE CSRLIN + 2, 1: PRINT USING F1$; CUMU * CV;
1560 LOCATE CSRLIN + 1, 1: PRINT USING F2$; E * CV;
1570 ELE = 1: CUMU = E
1575 LOCATE CSRLIN + 1, 1: PRINT USING F3$; ELE; ELEQ * CV; CUMU * CV;
1580 FOR ELE = 2 TO N - 1
1585     LOCATE CSRLIN + 1, 1: PRINT USING F2$; C(ELE - 1) * CV;
1590     CUMU = CUMU + C(ELE - 1)
1595     LOCATE CSRLIN + 1, 1: PRINT USING F3$; ELE; ELEM * CV; CUMU * CV;
1600 NEXT
1605 LOCATE CSRLIN + 1, 1: PRINT USING F2$; C(N - 1) * CV;
1610 CUMU = CUMU + C(N - 1)
1615 LOCATE CSRLIN + 1, 1: PRINT USING F3$; N; ELEQ * CV; CUMU * CV;
1620 CUMU = CUMU + E
1625 LOCATE CSRLIN + 1, 1: PRINT USING F2$; E * CV;
1630 LOCATE CSRLIN + 1, 1: PRINT USING F1$; CUMU * CV;
1670 LOCATE STARTLIN + 2, 1: COL = 30: GOSUB 3000           ' Draw the filter
1675 COLOR 3, 0: LOCATE 25, 13: PRINT "Press Shift-PrtSc to print, Q to quit, R or
" + ENTER$ + " to revise";
1680 T$ = INPUT$(1): COLOR 7, 0: CLS : IF T$ = "q" OR T$ = "Q" THEN END ELSE FIRST
= 0: GOTO 70
1689 '
1690 ' Subroutine for Chebyshev response
1700 C = 2 * RIP / 17.37
1710 BETA = LOG((EXP(C) + 1) / (EXP(C) - 1))
1720 GAMMA = .5 * (EXP(BETA / (2 * N)) - EXP(-BETA / (2 * N)))
1730 FOR K = 1 TO N
1740     A(K) = SIN(.5 * (2 * K - 1) * PI / N)
1750     B(K) = GAMMA ^ 2 + SIN(K * PI / N) ^ 2

```

```

1760 NEXT K
1770 G(1) = 2 * A(1) / GAMMA
1780 FOR K = 2 TO N
1790     G(K) = 4 * A(K - 1) * A(K) / (B(K - 1) * G(K - 1))
1800 NEXT K
1810 NN = N / 2
1820 NNN = (N + 1) / 2
1830 ' IF NNN-NN<0 THEN AG1=1 ELSE
IF NNN-NN=0 THEN AG1=2
ELSE AG1=3
1900 ON (2 + SGN(NNN - NN) * 1) GOTO 1910, 1910, 1930
1910 G(N + 1) = ((EXP(BETA / 2) + 1) / (EXP(BETA / 2) - 1)) ^ 2
1920 RETURN
1930 G(N + 1) = 1
1940 RETURN
1950 '
1990 ' Subroutine for Butterworth response
2000 POV2 = PI / 2
2010 FOR K = 1 TO N
2020     G(K) = 2 * SIN(POV2 * (2 * K - 1) / N)
2030 NEXT K
2040 G(N + 1) = 1
2050 RETURN
2950 '
2990 ' Subroutine to draw an N-pole filter starting at CSRLIN,COL
3000 TOPEND$ = CHR$(218) + CHR$(196) + " " + CHR$(179) + " " + STRING$(10,
CHR$(196)) + CHR$(191)
3010 TOPGAP$ = CHR$(179) + " " + CHR$(179) + SPACE$(11) + CHR$(179)
3020 MIDGAP$ = CHR$(179) + SPACE$(14) + CHR$(179)
3030 LROD$ = CHR$(222) + STRING$(13, CHR$(219)) + " " + CHR$(179)
3040 RROD$ = CHR$(179) + " " + STRING$(13, CHR$(219)) + CHR$(221)
3050 EVNBGAP$ = TOPGAP$
3060 ODDBGAP$ = CHR$(179) + SPACE$(11) + CHR$(179) + " " + CHR$(179)
3070 EVNBEND$ = CHR$(192) + CHR$(196) + " " + CHR$(179) + " " + STRING$(10,
CHR$(196)) + CHR$(217)
3080 ODDBEND$ = CHR$(192) + STRING$(10, CHR$(196)) + " " + CHR$(179) + " " +
CHR$(196) + CHR$(217)
3090 COLOR 14, 0
3100 LOCATE CSRLIN, COL: PRINT TOPEND$;
3110 LOCATE CSRLIN + 1, COL: PRINT TOPGAP$;
3120 LOCATE CSRLIN + 1, COL: PRINT LROD$;
3130 FOR I = 1 TO (INT(N + 1) / 2 - 1)          ' Fill middle
3140     LOCATE CSRLIN + 1, COL: PRINT MIDGAP$;
3150     LOCATE CSRLIN + 1, COL: PRINT RROD$;
3160     LOCATE CSRLIN + 1, COL: PRINT MIDGAP$;
3170     LOCATE CSRLIN + 1, COL: PRINT LROD$;
3180 NEXT
3190 IF (N + 1) / 2 = INT((N + 1) / 2) THEN GOTO 3250

```

```
3200 LOCATE CSRLIN + 1, COL: PRINT MIDGAP$;      ' Finish odd-number
3210 LOCATE CSRLIN + 1, COL: PRINT RROD$;
3220 LOCATE CSRLIN + 1, COL: PRINT ODDBGAP$;
3230 LOCATE CSRLIN + 1, COL: PRINT ODDBEND$;
3240 GOTO 3270
3250 LOCATE CSRLIN + 1, COL: PRINT EVNBGAP$;      ' Finish even-number
3260 LOCATE CSRLIN + 1, COL: PRINT EVNBEND$;
3270 COLOR 7, 0
3280 RETURN
```

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